

## EFFECT OF REARING METHOD ON CHUKAR SURVIVAL

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**ABSTRACT.**—Survival of adult chukar-imprinted, game farm (sibling human-imprinted), and wild chukars was compared in three releases (two sites). Combined results indicate similar ( $P < .05$ ) survival for adult-imprinted and wild chukars, but lower rates ( $P < .05$ ) for game farm chukars. With early behavioral conditioning, some potential exists for using captive-reared chukars to establish new populations.

*Key words:* chukar, chukar rearing, partridge, imprinting, behavior, propagation, survival.

Captive-reared game birds released in the wild generally have poor survival (Csermely et al. 1983, Krauss et al. 1987). A probable reason is behavioral deficiency (Hessler et al. 1970, Roseberry et al. 1987). Hess (1973) reported that imprinting is indispensable for survival of an animal under natural conditions. Thaler (1986) and Dowell (1989) observed improved predator-avoidance behavior of "properly" imprinted game birds. Postnatal visual imprinting as well as embryonic auditory imprinting (Bailey and Ralph 1975) appear to be important. Our objective was to evaluate survival of captive-reared (adult chukar-imprinted vs. conventional game farm-reared) and wild chukars (*Alectoris chukar*).

### METHODS AND STUDY AREAS

#### Adult-imprinted Chukars

Chukar eggs were exposed during the final week of incubation to recorded adult chukar vocalizations. The recordings, from the Cornell Laboratory of Ornithology Library of Natural Sounds, appeared to fit the description of the "rally call" described by Stokes (1961) (recorded vocalizations of incubating or brooding hen chukars were not available).

The brooding facility was a 6.1 × 15.2 × 2.1-m room at the Brigham Young University (BYU) Poultry Research Unit (Provo, Utah). Feed and water were provided through automatic sys-

tems, and chukar habitat was mimicked by covering the floor with gravel, small shrubs, grass, and rocks.

Chicks were removed from the incubator within 5 h after hatching and transferred to the brooding facility without allowing exposure to humans. Six adult chukars were released so that the chicks could visually imprint on them.

When four weeks old, the chicks were allowed to access a 5.6 × 22.9 × 2-m outdoor pen. The outdoor pen was visually isolated because of its solid walls and the netting-covered top. Cover was provided by grass, small shrubs, and two deciduous trees.

A hawk model was passed (rope/pulley system) over the pen and a dog introduced twice weekly so chicks could associate adults' alarm calls with predator presence.

#### Game Farm Chukars

Chukars (same genetic stock as the adult-imprinted birds) were raised at the Utah Division of Wildlife Resources (DWR) Game Farm in Springville, Utah, under conventional methods (brooded in box-type brooders, fed and watered with human contact [sibling/human-imprinted], and moved into flight pens at four weeks of age).

#### Wild Chukars

Wild chukars were trapped in the Dugway and Thomas ranges, Utah, 3–5 August 1989.

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### Release Site I

Antelope Island, located in the Great Salt Lake in Davis County, Utah, varies in elevation from 1252 m to 2010 m. In size it is 24 × 8 km and covers 10,409 ha. Rocky slopes and grassland are the dominant ecological types. Average yearly high and low temperatures are 35.9 and -12.2 C, respectively (Jones 1985). Antelope Island had self-perpetuating and self-sustaining chukar populations until the severe winter of 1983-84, after which no chukars were observed.

On 5 August 1989 (release I), 80 chukars from each group were released, 13 of which were equipped with backpack-mount radio transmitters (Slaugh et al. 1989, 1990). On 2 May 1990 (release III) 65 adult-imprinted, 65 game farm, and 4 wild chukars were released; 9 chukars in each captive-reared group and all 4 of the wild group were fitted with radio transmitters. Radios were attached to every fifth bird captured from the captive-reared groups to reduce bias from ease of capture. All birds were fitted with patagial tags and legbands. Captive-reared chukars were 14 weeks old in release I and 22 weeks old in release III. Wild chukars in all releases were trapped 3-5 August 1989.

Eighteen coyotes (*Canis latrans*) were removed from site I preceding the 1990 release. Mortality data were recorded daily during the first two weeks, then weekly thereafter.

### Release Site II

The second study site was the Sterling Hollow/Wind Rock Ridge area of Spanish Fork Canyon. This area ranges in elevation from 1470 m to 3057 m, and the dominant ecological type is mountain brush. Annual precipitation averages between 35.5 cm and 52 cm. Average yearly high and low temperatures are 40 C and -30 C, respectively.

On 25 September 1989 (release II), 11 birds from each group were radio-marked and released at site II. Captive-reared groups were 21 weeks old. Mortality was recorded daily for two weeks, then weekly thereafter.

### Statistical Analysis

Data were analyzed using a Product Limit (Kaplan-Meier) estimator; a log rank test was used to compare survival curves (Pollock et al. 1989). Only radio-marked birds were compared since their observation was not biased by ease of approach and proximity to release site.

## RESULTS

### Release I

All adult-imprinted and game farm chukars (both radio and patagial tagged) died within three weeks of release (Fig. 1) with no differences between groups ( $P < .05$ ). Wild birds decreased in number shortly thereafter but experienced higher survival rates ( $P < .05$ ) than captive-reared groups. Coyote predation was the principal cause of mortality.

### Release II

There were no significant ( $P < .05$ ) differences (Fig. 1).

### Release III

Mortality was similar ( $P < .05$ ) for the adult-imprinted and wild groups but higher ( $P < .05$ ) for game farm chukars (Fig. 1).

### All Releases

Combined data for releases I, II, and III indicate similar ( $P < .05$ ) survival for wild and adult-imprinted groups, both having higher ( $P < .05$ ) values than game farm birds (Fig. 1).

## DISCUSSION

During release I, wild birds moved quickly to high, rocky areas, whereas captive-reared birds remained at lower elevations and sought cover in the sparse vegetation, where they suffered high mortality. Immediately following demise of captive-reared birds, wild birds began to be killed.

Adult-imprinted and wild birds demonstrated the greatest fear response to human presence, whereas game farm birds tolerated approach. These findings correspond with those of Csermely et al. (1983), who found that red-legged partridges (*Alectoris rufa*) displayed greater fear response toward humans when isolated from them during imprinting. The flightier behavior of the adult-imprinted chukars would likely provide more hunting sport than game farm birds but did not offer sufficient survival advantage under the existing predator pressure.

Adult-imprinted birds apparently had a behavioral advantage over the game farm birds that was not expressed in release I but was demonstrated at release II, apparently due to lower predator pressure. Wild chukar mortality was similar for releases I and II.

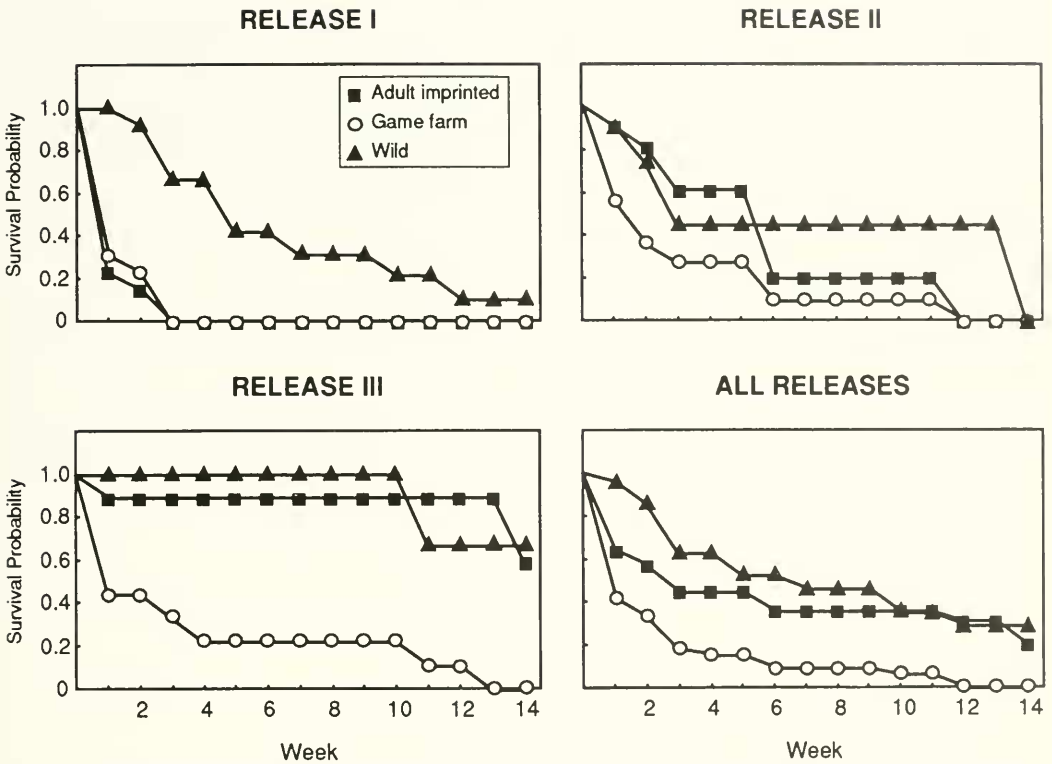


Fig. 1. Chukar survival probability curves: (1) release I (Antelope Island, 5 August–15 November 1989)—no difference ( $P < 0.5$ ) between game farm and adult-imprinted chukars, but both groups are lower than wild chukars; (2) release II (Spanish Fork Canyon, 5 September–12 December 1989)—no differences ( $P < .05$ ) between groups; (3) release III (Antelope Island, 2 May–5 August 1989)—no differences ( $P < .05$ ) between adult-imprinted and wild, but both groups are higher than game farm chukars; (4) all releases—no differences ( $P < .05$ ) between adult-imprinted and wild, but lower for game farm chukars.

Results from release III indicated that survival on Antelope Island for all groups was greater than in the previous year, especially for the adult-imprinted group. The improvement was attributed to predator removal, which may be beneficial even in establishing transplanted wild birds in good habitat. Season of the year may have affected survival, as alternative prey abundance and predator location on the island may have varied. Jonkel (1954), however, observed little difference in chukar survival related to season of release.

Combined data from all releases suggest that captive-reared chukars can be used to establish wild populations if given proper early behavioral conditioning. This study, however, does not provide information on reproductive success.

#### ACKNOWLEDGMENTS

We express appreciation to the Utah Division of Wildlife Resources for project funding, also to M. A. Larsson and J. Fillpot (Utah Division of Parks and Recreation—Antelope Island State Park) and BYU and DWR personnel who assisted with the project, and to G. C. Pixton (BYU Statistics Department) for statistical assistance.

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Received 12 June 1991  
Accepted 14 January 1992